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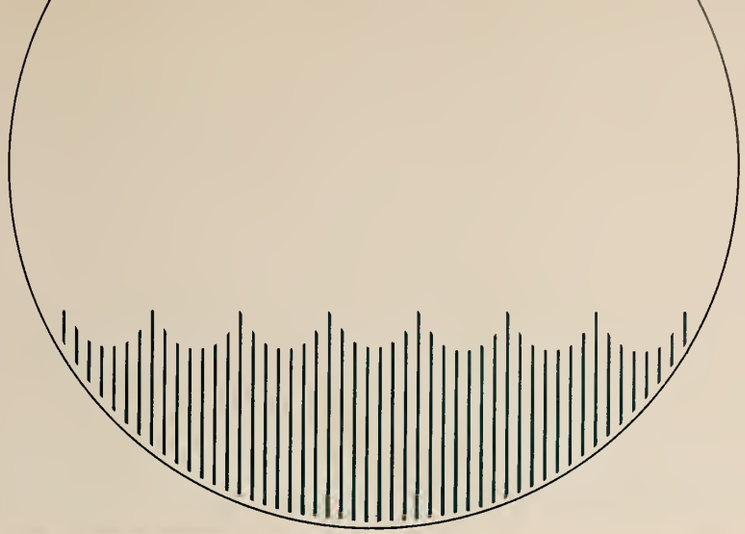
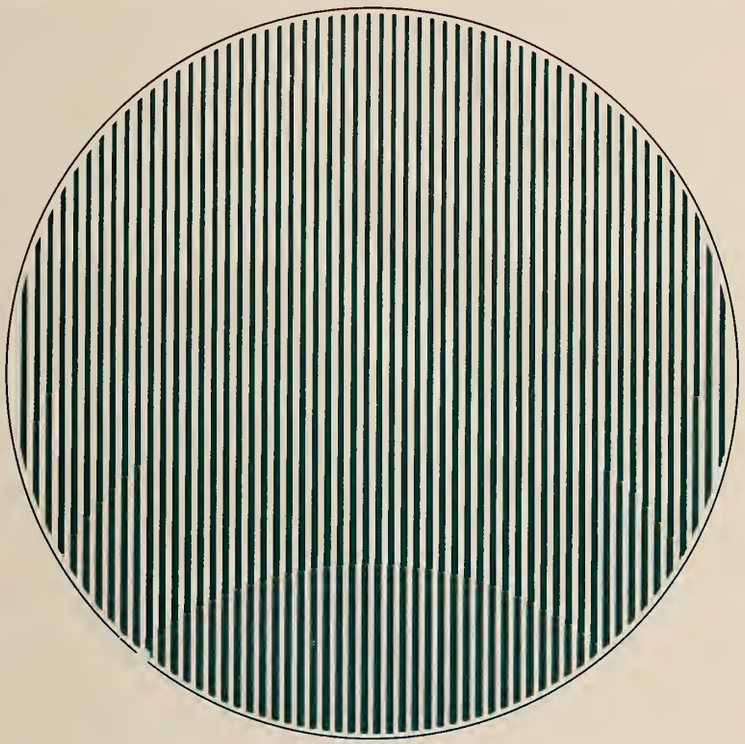
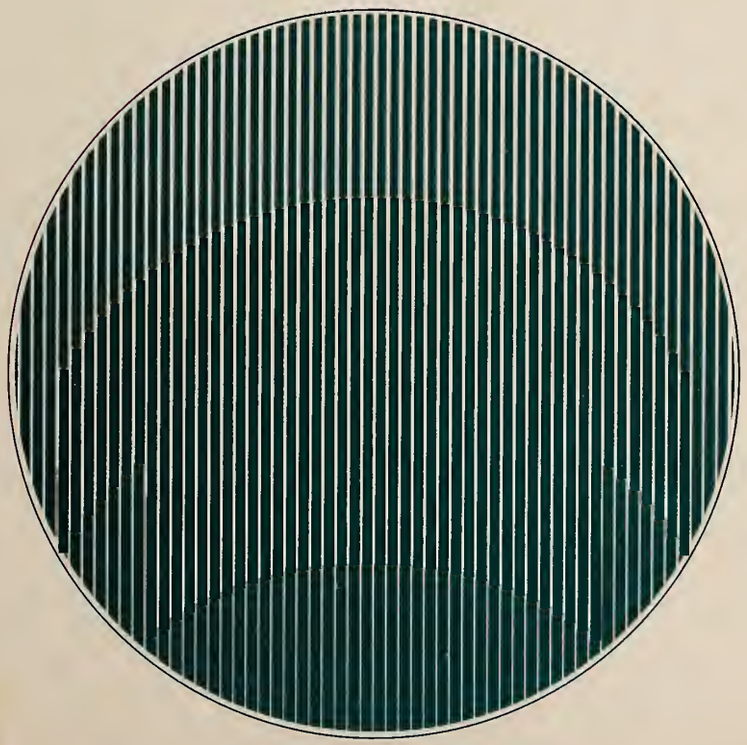


ONTARIO'S COTTAGE POLLUTION CONTROL PROGRAM





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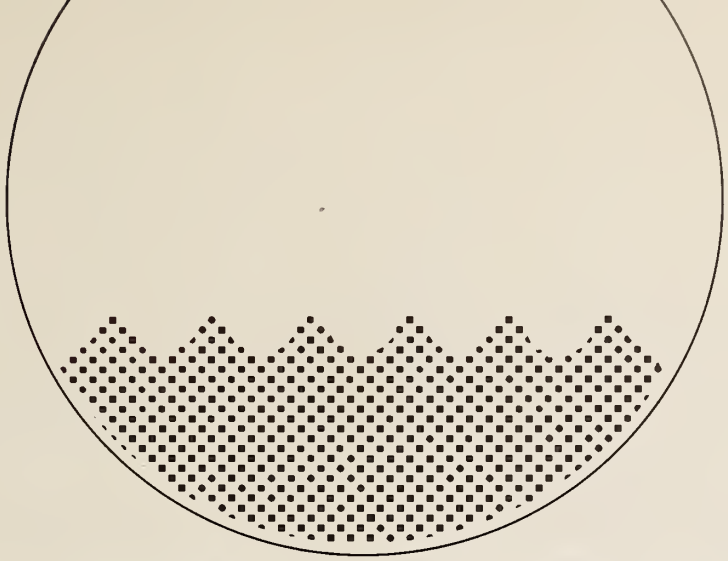
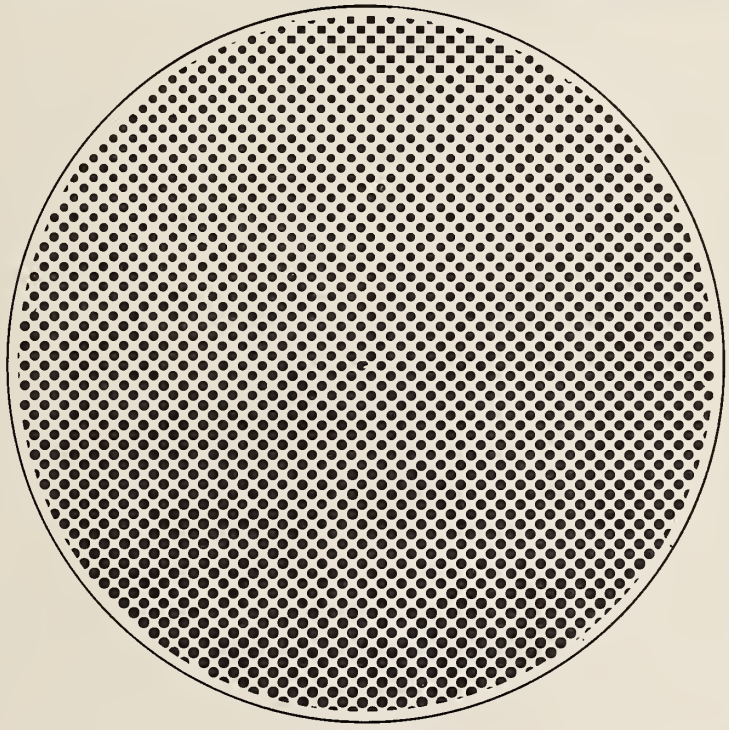


REPORT ON THE COTTAGE POLLUTION CONTROL PROGRAM 1970/71
PRIVATE SYSTEMS DETECTION AND ABATEMENT



ONTARIO
MINISTRY OF THE ENVIRONMENT

FOREWORD

The work covered by this report was completed by staff of the Public Health Engineering Service.

On December 1, 1971, staff was transferred to the Department of the Environment, Private Waste & Water Management Branch under whose auspicies the report was finalized.

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PREFACE

EFFECTS OF POLLUTION

Raw sewage* or inadequately treated sewage, when discharged into the water or onto the ground, can be a hazard to health and an environmental pollutant. Such used water may contain human body waste, kitchen or sink wastes with food particles and bath, shower or laundry wastes, all of which are potentially injurious both to health and to environmental quality.

Sewage also includes other wastes that are putrescible, toxic or otherwise harmful, such as chemical wastes, but these are not usually encountered as discharges from private systems in the recreational areas. Considerable quantities of gasoline and oil are used in these areas, however, and such liquids are very harmful if allowed to escape into the natural environment. Great care should be taken in their handling.

Other main kinds of waste produced in cottages are garbage and refuse. These solid wastes are not classed as sewage. Nevertheless they contain putrescible substances which provide food and heat for bacterial growth and an almost ideal breeding place for flies, if exposed on the ground. Garbage and refuse dumps that are not well covered are a frequent source of offensive odors and constitute a fire hazard.

Winds may scatter loose papers and cause a litter problem. When putrescible substances in the garbage start to break down into simpler compounds by bacterial action heat and odors are generated, as noted earlier, and very strong liquids are produced which will cause serious pollution if they reach ground water or surface water before decomposition is complete.

CONTROL OF PRIVATE SEWAGE DISPOSAL SYSTEMS

Increases in population and the various human activities accompanying such increases tend to make the control of man's environment difficult. Regardless of the difficulties involved, however, modern conditions force upon society the need and responsibility to carry out appropriate environmental control measures to ensure protection of health and promotion of human comfort and well being.

Provision of safe water and the collection and disposal of domestic and industrial wastes are among the important needs of modern man. Control of private sewage disposal systems is a factor in the prevention and abatement of land and water pollution, and the importance of this activity cannot be over-estimated. Where private properties are served or are to be served by piped water supplies under pressure, one control method is designed to ensure adherence to specifications for satisfactory private sewage disposal systems.

With existing developed premises systems sometimes cause direct pollution, or are classed as P.H.N. (Public Health Nuisance) when separated systems have been installed.

Another problem occurs where existing systems are substandard. They may not have been proved to be Public Health Nuisances or to be polluting directly or indirectly. To effect control in such cases, it will be necessary to provide expedient solutions.

For example, where there is no piped water supply, hand-carried water used for kitchen and hand washing may be discharged to a leaching pit where soil and other conditions make this acceptable, provided human wastes can be disposed of satisfactorily in an earth privy pit or vault privy.

Alternatively, where an existing property is served by pressure water supply and there is insufficient soil or space, or other conditions exist which render the site unsuitable for a septic tank and subsurface disposal field, a raw sewage holding tank is satisfactory, provided

* The term 'sewage' is used to describe all discharged waste water which has been used for sanitary purposes.

acceptable arrangements are made for the collection and disposal of the holding tank contents.

The program for control can be divided into two main parts:

1 An abatement program in which existing systems are investigated, either on a programmed basis or in response to complaints to detect and correct those that are found to be unsatisfactory.

2 A preventive program, designed to prevent the installation of substandard systems, which is based on

- land development surveillance in which all lots proposed for development in unsewered areas are inspected to ensure that only those lots which are suitable for on-site disposal or can be made suitable, or those where holding tanks are feasible and can be serviced will be recommended for approval.

- pre-construction approval of new buildings in unsewered areas to ensure the adequacy of proposed designs for sewage disposal systems required to serve the buildings.

- certifications of all new or altered private sewage disposal systems to ensure that regulatory standards are met.

- licensing of haulers of sewage from holding tanks, and of persons engaged in constructing or repairing systems.

This report deals with the program carried out in the fiscal year 1970/71 to detect and correct unsatisfactory systems in establishments on the shores of selected lakes, as outlined under 1 above.

SUMMARY

1 GENERAL

This report deals with the activities, results, observations and conclusions of the program for detection and correction of faulty private sewage disposal systems with associated lake bathing water quality studies on selected lakes in the Kawartha Lakes region, in Algonquin Park, in the Muskoka District and in the Thousand Islands area of the St. Lawrence River during the period between June 15, 1970 and March 31, 1971.

The initial phase of this project has had good public acceptance, and the co-operation received from cottagers both individually and through their associations has been excellent. Although this new program was developed in a short period of time, it was possible to exceed the objective for 1970/71 of investigating 4,000 sewage disposal systems.

The results of the detection surveys from the 4,554 systems inspected, which are shown in detail for each lake in Table 1, indicate that 65.6% are satisfactory, 15.7% are unsatisfactory and 18.7% are either substandard or information was insufficient to classify them. The results of the bacteriological and chemical water sample results are shown in Tables 2, 3 and 4, while the results of the abatement work to March 31, 1971 are shown in Table 5.

The in-shore bathing water quality work indicates that over 95% of the areas were suitable for swimming at the time of sampling. It should be understood that these were isolated samples indicative of water quality at a particular location at the time of sampling only.

OBSERVATIONS AND CONCLUSIONS

1 The objective of the program to investigate 4,000 systems was exceeded.

2 There are approximately 250,000 cottages in Ontario at present.
At the present rate, it would take 55 years to survey all the cottages.

3 The Abatement Program commenced on September 12, and owners were interviewed at their establishment and in the office (after Labour Day). A program of follow-up telephone calls, meetings, and correspondence with cottagers was carried out throughout the winter months.

4 The findings of the detection staff were verified in a high percentage of the establishments visited by abatement technicians.

5 Many sewage disposal systems could not be properly evaluated in the owner's absence at the time of the initial survey, and consequently have to be revisited by abatement technicians.

6 The majority of Public Health Nuisances inspected were found to be disposing of their sink, laundry and/or bath wastes in an unsatisfactory manner.

7 None of the establishments classified as 'other' have been followed up. These will be investigated when all polluters and public health nuisances are corrected.

8 It has been very gratifying to find that virtually all owners contacted have been willing to take the necessary steps to abate pollution or nuisance-causing systems or practices. This co-operation is,

and will be, vital to the success of the program.

9 The previously recognized need to have detailed engineering studies carried out on the feasibility of holding tank pumpout and disposal servicing systems was confirmed.

10 The lack of uniformity in practices and standards of private sewage disposal systems in the different program areas was confirmed by the many and varied types of installations inspected. This confirms the need for standards, regulations and licensing.

11 There is need for the dissemination of public information on pollution control matters pertaining to private sewage disposal systems.

12 There is a need for the continuation of dialogue with cottagers' associations and other interested public groups that was started by personnel involved in this program. It is a recommendation of this report that such efforts be increased by the provision of staff to do this essential work on an informed technical basis.

INTRODUCTION

GENERAL

This report on the Cottage Pollution Control Program for the fiscal year 1970/71 forms part of the overall Program for Environmental Management of Recreational Waters in Cottage Areas of Ontario. It is in addition to the Committee report to the Advisory Committee on Pollution Control of March 1970, the adoption of which led to the Government decision on May 28, 1970 to authorize establishment of this program.

A progress report of activities and results to September 30, was tabled in the Legislature on October 22, 1970. The program has two parts, as follows:

Part 1 Detection and abatement of faulty private sewage disposal systems on selected lakes, together with a study of water quality in the lakes.

Part 2 Evaluation of the suitability of all new lots on unserviced land proposed for development throughout Ontario.
This report deals with Part 1.
Part 1 objectives are described in more detail below:

- The inspection of 4,000 systems used for recreational purposes during 1970 to detect private sewage disposal polluting the lakes or causing other health hazards or environmental damage. Following initial inspections, abatement work to ensure correction of those systems found to be unsatisfactory.

- Collection and analyses of water samples from bathing areas, stream outlets, wells, taps, and drinking water were undertaken.
- Field surveys on the selected lakes to determine inshore and off-shore lake water quality.

Although designed primarily for intensive bacteriological sampling, the survey also included some samples taken for chemical and physical analysis.

All the activities reported on were to reinforce and supplement the ongoing programs of local health agencies for control of private sewage systems and the improvement of lake water quality throughout Ontario.

The off-shore lake water quality field surveys were completed and reported by the Ontario Water Resources Commission.

AREAS OF WORK

The program areas selected for 1970 were in the Kawartha Lakes region, in Algonquin Park, in the Muskoka District and in the Thousand Islands area of the St. Lawrence River. This selection provided a reasonable geographic distribution of effort with the main emphasis on the Kawartha Lakes.

In the selection of the lakes to be surveyed several factors were taken into consideration. The Interdepartmental Task Force report recommended to the Advisory Committee on Pollution Control "that first priority for 1970 be the survey and correction of Stony and Clear Lakes" in the Kawartha region. This area is one of the older and popular resort areas where, along some shorelines, there is a high density of cottage population, and deterioration or breakdown of waste disposal systems could be encountered. Present and future development were also taken into account.

Before the new 1970/71 Cottage Pollution Control Program was finalized, it had already been planned to conduct special cottage sanitary surveys in Algonquin Park, Sparrow Lake, Cameron Lake and among the Thousand Islands. These planned surveys were integrated with the new program which was to commence in the Kawartha Lakes region and to include Stony, Clear, Buckhorn, and Lovesick Lakes, as well as a portion of Chemong Lake.

REGIONAL PHYSIOGRAPHY

THE KAWARTHA LAKES

Stony Lake, Clear Lake, Lovesick Lake, Upper and Lower Buckhorn Lakes, and Chemong Lake are found within the townships of Smith, Douro, Summer, Burleigh, Harvey, Innismore, in the County of Peterborough.

The Kawartha Lakes serve as reservoirs linking sections of the Trent Canal system between the Otonabee River and Pigeon Lake. A change in elevation of 39 feet necessitates navigation locks at Burleigh Falls and Buckhorn.

The Kawartha Lakes lie along the juncture of the Palaeozic limestone and the crystalline rocks of the Canadian Shield. They occupy portions of preglacial valleys which formerly drained towards the southwest and are probably somewhat deepened by ice action. These lakes drain from one to the other over the lowest saddles in the rock between them, which accounts for their zig-zag pattern.

Stony Lake tributaries include Jack and Eels Creeks, and 7 other minor inlets. The major outlet is through Clear Lake to Katchiwano Lake and the Otonabee River. A secondary outlet is through Gilchrist Bay into Drummer Lake. From this point the flow continues down the Indian River to Rice Lake.

THE THOUSAND ISLANDS

The area along the shoreline of the St. Lawrence River included in the project extended from the west boundary of Leeds County, the front of Leeds and Lansdowne Township and the front of Escott Township northeast to Mallorytown Landing, the front of Yonge Township, and the Thousand Islands on the Canadian side of the boundary between Canada and the United States.

While the main cottage population is found on the islands, there are also small shoreline communities, Rockport and Ivy Lea, which increase in population during the summer. There is some privately-owned undeveloped land on the river shoreline.

Knight's Creek emerges at Champagne Point 6½ miles east of Gananoque and La Rue Creek empties into the St. Lawrence at Cherry Pt., 1½ miles west of Mallorytown Landing. Several other small tributaries are found along the northern shore, which drain the marsh and bog area found between the Ivy Lea Bridge and Mallorytown Landing.

CAMERON LAKE

Cameron Lake links Balsam Lake and Sturgeon Lake, and is located in the Northeastern corner of Fenelon Township, County of Victoria. There are three main inlets into the lake, Burnt River, Perrin Creek and Martin Creek. Flow from Balsam Lake passes through the lock system at Rosedale. Cameron Lake empties into Sturgeon Lake at the southern boundary of Fenelon Falls, dropping in elevation some 24 feet.

SPARROW LAKE

Sparrow Lake, in the District of Muskoka, is

the boundary of Orillia, Matchedash and Morrison townships.

It is roughly 4 miles in length from the outlet of the Severn River to Maclean Bay. It measures more than 1½ miles at its widest point. Including two large bays, Maclean and West, the lake has more than 19 miles of shoreline.

Heterogeneous deposits overlying granite bedrock, consisting of mixed sand and salt with occasional clay and rock, are found in the area.

The shoreline varies from shallow sandy shores, which are conductive to weed growth, to steep rock cliffs where the water is deep and little vegetation grows. This is especially noticeable between the inlet at the Severn River where sand and salt is piled up, and the higher area along the eastern shoreline where wave action is vigorous.

The lake is 698 feet above sea level but the surrounding land can rise sharply to 758 feet. Locks are required near Severn Bridge to compensate for the drop in elevation between Lake Couchiching and Sparrow Lake. The river itself in this area is quite heavily populated with cottages.

There are ten inlets draining into the lake. The main one is the Severn River, which, along with the Kashe River from Kashe Lake to the northeast, contributes most of the flow. The others drain from low marshy areas with heavy vegetation growth. The only outlet is the continuation of the Severn River to Georgian Bay.

CANOE LAKE

From the northernmost point of the lake, which lies entirely in Peck Township, the Oxtongue River at the southern end is roughly 3 miles away,and the average width of the lake is less than 1 mile. The amount of shoreline including the five main islands is over eleven miles.

The major flow into Canoe Lake is from a dam, which is regulated by the Department of Lands and Forests for flood control. There are several small tributaries, such as Sims Creek and Hichary Creek, in the northeastern section of the lake.

On the western shore of the lake three main creeks meander through a swampy area and empty into the lake near its midsection. The elevation of the lake is approximately 379 feet above sea level. It is a relatively deep lake (150 feet), but there are also swamp and bog areas whose exposure is greatly affected by floor control levels of the dam.

JOE LAKE AND LITTLE JOE LAKE

These two small lakes are on the border of Hunter and Peck Townships in the District of Nippissing in Algonquin Provincial Park, about 3 miles north of Highway No. 60 from the Department of Lands and Forests airbase. The lakes represent true Precambrian Shield topography, long and narrow valleys which were formed in the glaciation movement.

The dense surrounding vegetation and crisp, refreshing water make an ideal spot for summer recreation. The lack of domestic development has also increased the value of the lakes as a 'wilderness area'. The two lakes are fed by Baby Joe Lake to Little Joe Lake from Tepee Lake to Joe Lake.

TEPEE LAKE

Tepee Lake is accessible by the same road as Joe Lake and Little Joe Lake. The lake is entirely within Hunter Township and has roughly 3 miles of shoreline. Undulating rocks prevail, representative of Precambrian Shield, and soil of sand silt with a few traces of gravel is found. In some areas the granite bedrock lies close to the surface and can be seen quite easily where the elevation in land surfaces rises steeply from the shore.

TEA LAKE

Tea Lake is south of Canoe Lake but still north of Highway No. 60. It is connected with Canoe Lake by the Oxtongue River. At its longest point it is 1-2/3 miles long and 2/3 of a mile wide. The shoreline is irregular and comprises about 4 miles.

From the highway the motorist can get an excellent view of the typical Algonguin Lake that was gouged out by glacial action and later filled with water. The glacial debris can also be seen along the highway in the form of sands, gravels, silt, stones and boulders.

The soils of the area are light and shallow and not conducive to agriculture, however the lake is surrounded with mixed forest trees.

SMOKE LAKE

Smoke Lake is the largest of the six lakes and had the largest cottage population, although there were no commercial establishments or youth camps. There is no land route around Smoke Lake, and almost every cottage is without electrical services. The Lands and Forests airbase and hangar is situated on the utmost northern point of the lake, where it is sheltered in a small bay and easily accessible from Highway No. 60.

In addition to Ragged Creek, seven or eight other tributaries drain into the lake.

The lake drains into Tea Lake via Tea Creek. The creek is rather narrow with dead tree stumps and logs crowding the shores. However, navigation is possible through a deep channel in the middle of the creek.

Because of the influence of the precambrian rocks, which do not weather as rapidly as other types, the top soil is light. However, the vegetation that is present thrives on the existing soil and is complemented with a good rainfall amount of 30 to 35 inches per year, with autumn maximum.

PLANNING

PLANNING

The lakes chosen for the 1970/71 survey are located in five Health Units areas in Peterborough County, Muskoka-Parry Sound, Simcoe County District, Haliburton-Kawartha-Pine Ridge District, Leeds-Grenville and Lanark District, and the Northern Ontario Public Health Service. The Health Units are responsible for health inspection services in their areas, and the planning of this program provides reinforcement and supplements the ongoing local health agencies' programs.

The planning for the field work in the cottage survey included the arrangements for equipment and staff field accommodation prior to the recruitment of additional permanent personnel.

Staff attended a two-week orientation course of instruction held at the Ontario Forest Technical School, Dorset. The subjects of instruction included domestic waste disposal and refuse disposal methods. A field team of eight students proceeded to the lakes about the middle of June, followed by a second group in mid-July.

Planning was completed for correction of the cottage waste disposal systems found to be faulty or unsatisfactory by field survey teams.

DETECTION

A GENERAL

Detection surveys began in June 1970, and the bulk of the field work was completed by September 15, 1970. Office work and field reconnaissance surveys for the work proposed in the 1971/72 fiscal year were carried out between September 15, 1970 and March 31, 1971.

Detection work consists mainly of site inspections, preparation of detailed sketches, interviews with owners, completion of detailed questionnaires containing information for a complete sanitary survey of each establishment, classification of each waste disposal system, preparation of data for abatement of faulty systems, collection of water samples, winter mapping and reconnaissance, and groundwater tracer sampling of selected establishments.

B PROCEDURES

Detection and Correction of Defective Systems

1 Large scale maps of the lakes to be surveyed were obtained from the Hydro Electric Power Commission of Ontario, and the positions of all known cottages and other establishments on the lakes were carefully marked. Several sources were used to establish the number of cottages on the shoreline of lakes, rivers and islands.

The District Assessment Commissioners provided data from the assessment rolls. Cottage associations often had an accurate list of the cottage owners. This information was useful in establishing the projected workload and time schedules for the field teams.

2 The lakeshore was examined and the information obtained was compared with that marked on the map. Corrections and additions were made where necessary.

3 All cottages and other establishments were then systematically numbered on the map for identification purposes.
4 Copies of a pamphlet entitled, The Cottage, The Lake, and You, were distributed to explain the purpose of the program and to solicit the cottagers' co-operation. Several cottagers' associations assisted in the distribution of this pamphlet, and some gave time at their annual meetings for presentations by department staff to explain the program.
5 Each cottage was visited and, where possible, the occupant was interviewed. Water samples were collected in the shoreline bathing area and from the cottage well or tap. A questionnaire was completed for each cottage regarding occupancy, water usage, sewage disposal facilities, sanitary fixtures, and garbage and refuse disposal practices. This was supplemented by an inspection of the premises.
6 In some cases, a tracer solution of dyes and selected radioisotopes was added to the sewage system to assist in tracing the movement of ground water between the system and the lake. Sampling holes were bored to permit sampling of the ground water. These samples were analyzed for total and faecal coliform bacteria, and the presence and concentration of the tracers.

This initial work is intended also to provide data for designing better techniques for the detection of seepage.
7 The collected data were tabulated, collated and classified.
8 All premises fronting on the lakes or possibly contributing to lake pollution were classified. The premises include cottages, marinas, hotels, motels, trailer camps, camp sites, and boat houses. Premises were classified in one of the following groups:

Satisfactory
Directly Polluting
Public Health Nuisance
Other

Satisfactory systems meet the standards and are not polluting.

A *Directly Polluting* system is one which obviously permits sewage to contaminate the ground water or to reach the lake either by direct discharge through a pipe or ditch or over the ground surface, or is proven to be polluting by means of tracer or other tests, or it permits leachate from garbage to reach the lake.

A system is classified as a *Public Health Nuisance* if any water, such as laundry water, kitchen sink water, shower bath or shower tub water, or toilet wastes, all of which are included in the term "sewage", is exposed on the surface of the ground even if it does not apparently drain toward the lake. Kitchen waste water thrown on the ground or tile beds over which sewage is ponding are examples of health nuisances. Improper garbage and refuse disposal will also result in the use of this classification.

Other systems are those which have not been proved to be polluting but which fail to meet the standards of good design, construction and location.

The results from the 4,554 systems surveyed are classified in four groups under three headings as noted on the appended 'Detection Survey Results', as satisfactory, unsatisfactory, or other. Results indicated that 66% of the systems are satisfactory, 15% are unsatisfactory, and 19% are other.

DETERMINATION OF IN-SHORE LAKE WATER QUALITY

1 Water samples for bacteriological analysis were taken at each cottage from the bathing area and from the well or tap at the cottage. Samples were also taken at inlet and outlet streams on the lakes. Detailed analysis of these data was completed. The greatest number of samples are from bathing areas and are detailed on the maps and in the accompanying tabulation.
2 To avoid unnecessary workload and expense, not all samples were subjected to full dilution in the laboratories. Drinking water samples were not diluted at all, and other samples were diluted according to the instructions given by the sampler.
3 A mobile laboratory was placed on Clear Lake by the Department of Health to perform the bacteriological work. Samples requiring chemical analysis were analyzed in the Central Laboratory in Toronto.

TRACERS

GENERAL

An essential part of the cottage pollution control program is the application of tracing techniques to obtain a better understanding of the movement of ground water between the tile field and the receiving body of water.

By introducing tracer solutions into the sewage system of those premises suspected of polluting (i.e. which are in the other classification), tracing the movement of this known solution (which is moving with the ground water), and by checking the concentrations of various bacteriological chemical and radioisotopic parameters at various points along the path of the 'ground water – tracer solution' admixture it is possible to detect pollution that would otherwise remain undetected.

FIELD WORK

During August 1970, following some of the initial detection surveys, preparations were made to commence tracer work in selected areas on Cameron Lake.

Sampling bore-holes were drilled to depths below the ground water table. Soil samples from these bore holes were logged and analyzed in the Departmental laboratory.

Routine sampling of the water in the bore holes was carried out to obtain samples on a regular basis for analyses in the radiation protection laboratory and the public health laboratories.

TRACERS REPORT

Following the initial work carried out in the fall of 1970, further more intensive and extensive coverage was planned for August 1971, and was undertaken.

A detailed report covering results to November 1971 will be published in a separate report.

ABATEMENT

GENERAL

In the abatement or correction phase of the Cottage Pollution Control Program, abatement technicians are responsible for confirming detailed Polluters, and Public Health Nuisances, advising owners of the necessary corrections, obtaining formal agreements to abate, and inspecting and granting final approval upon completion of the work. Qualified technicians are entrusted with abatement duties which require great tact in dealing with the public and technical competence in the environmental control field.

ORGANIZATION

The Abatement Program is the second step in the Cottage Pollution Control Program.

For the 1970/71 program, some abatement technicians have been working out of a field office located in Peterborough when dealing with establishments in the Kawarthas. Thousand Islands and Algonquin abatement programs have been conducted from a Toronto based office.

PROCEDURE

The abatement program is fundamentally different from the detection program as it involves a significant amount of personal contact with owners, contractors, and municipal or other government agencies.

The following paragraphs describe briefly the procedure which the abatement team adopted for the current program.

Discussions between the Chief of the Public Health Engineering Service and the Medical Officer of Health for the region were carried out to determine the best means by which the province and the local health unit could co-operate. Most work for the 1970/71 program has taken place in the Kawartha Lake Region, which is under the

jurisdiction of the Peterborough Health Unit. In this area, the abatement program is being carried out entirely by the province, with the provision that all enforcement orders will be issued by the Medical Officer of Health.

All of the data sheets filled out by the detection team were analyzed and classified by the detection supervisors, and filed according to classification and lake.

The abatement team then extracted all of the files of establishments classified as either Public Health Nuisance or Polluting. These establishments were inspected by abatement technicians to confirm the findings of the detection team. Where the findings of the survey were not confirmed, the establishment in question was discussed further to decide upon the correct classification or further tests as necessary.

If the owner of the establishment was present at the time of inspection, the technician would discuss his problem and the steps necessary to abate pollution. A signed agreement to abate was obtained from the owner, indicating the steps to be taken and the date on which the work would be completed.

If the owner was not present at the time of inspection he was contacted by letter. Where necessary, interviews were arranged. In all cases, letters of confirmation were sent out.

Many establishments are re-visited on or after the completion date as indicated by the owner, at which time, the corrective procedures will be approved or further steps agreed upon.

The Polluters and Public Health Nuisances which have highest priority are followed up first.

A determination of whether a sub-standard system is in fact polluting can only be made while the establishment is in use. For example, further water sampling may be necessary for the evaluation.

LABORATORIES

GENERAL

The Public Health Laboratories and the Radiation Protection Laboratory provided the services necessary to analyze water samples submitted from the field, and to furnish the results of laboratory examinations. Water sampling and analysis in the detection and abatement program is of utmost importance.

The Public Health Laboratories staff analyzed shoreline bacteriological samples and samples taken at every fifth establishment further offshore, samples taken from sources of drinking water, bacteriological samples taken from observation wells used for tracer work, and chemical samples taken from inlets and outlets on the various lakes and from specific sources suspected of causing pollution.

Samples for chemical analysis were analyzed in Toronto. Samples for bacteriological analysis were analyzed at permanent or mobile laboratories in the field.

Samples taken from observation wells used in the ground water tracer program to be tested for the presence of tracers were analyzed by the Radiation Protection Laboratory in Toronto.

BACTERIOLOGICAL ANALYSIS OF WATER SAMPLES

7,559 shoreline, control and drinking water samples were taken as routine and are as detailed in Tables 2 and 3, *Bacteriological Test Results.*

Samples taken from Sparrow Lake were analyzed at the Public Health Laboratory in Orillia.

Samples taken from the Thousand Islands area were analyzed at a mobile laboratory located at Young's Point (on Clear Lake), which was operated by staff from the Public Health Laboratory in Peterborough.

The Membrane Filter technique was used by the laboratories in testing the water samples.

Drinking water samples received a routine test with 50 ml amounts being put through two membranes placed on Endo and FC agar at prescribed temperature for eighteen to twenty-four hours. Results were reported as Total and Faecal Coliforms per 100 ml. The maximum count reported for drinking water samples was 80+ Total or Faecal Coliforms per 100 ml.

Shoreline water samples and control samples were processed in a similar manner, but required 50 ml and 1 ml amounts to provide a higher range of counts. The maximum count reported for routine shoreline and control samples was 8,000+ Total or Faecal Coliforms per 100 ml.

A sample water report sheet is attached. This sheet shows the normal range of water samples taken, how they are coded, and how the results of laboratory testing are reported. The format has been revised for 1971/72.

The field procedure for co-ordinating the sampling and the laboratory analysis was simple, but efficient.

Samples were coded by lake, establishment number, and nature of the sample. This code was marked on the sample bottle and on the water report form. The bottles were kept cool through the day in insulated coolers. They were then stored in refrigerators until their delivery to the provincial laboratory.

When the laboratory had completed its testing the results were recorded on the water report form. One copy was returned to the field office for entry on the data forms, and one copy was forwarded for head office compilation.

CHEMICAL ANALYSIS OF WATER SAMPLES

Water samples for chemical analysis were taken routinely at most inlets and outlets on the lakes surveyed. The results of these samples are shown on the maps and included in Tables 4 and 5.

The normal tests were for nitrate, phosphate and ABS (Alkyl Benzene Sulphate).

Samples for chemical analysis were recorded on field maps and sent to the Public Health Laboratory in Toronto.

For determination of the nitrate level, the Ultra-violet Spectrophotometric Method was used. The levels were reported in mg per litre (p.p.m.) with a lower detection limit of 0.1 mg per litre.

For the determination of the chloride level, the Argentometric Method was used. The levels were reported in mg per litre (p.p.m.) with a lower detection limit of 1.0 mg per litre.

For the determination of the phosphate level, the Aminonaphthosulfonic Acid Method for Orthophosphate was used. The levels were reported in mg per litre (p.p.m.) with an initial lower detection limit of 0.1 mg per litre. This limit was later extended to 0.01 mg per litre.

For determination of the surfactant level (ABS), the Methylene Blue Method was used. The levels were reported as total apparent ABS in mg per litre (p.p.m.) with an original lower detection limit of 0.1 mg per litre. This limit was later extended to 0.025 mg per litre.

ANALYSIS FOR PRESENCE OF FLUORESCINE OR RHODAMINE-B

An aliquot of approximately 10 ml of the filtered water sample is placed in a test tube which is exposed to ultra-violet light, appropriately filtered, in a fluorometer. The fluorescence which results is filtered and compared with a standard to record its concentration in parts per billion (p.p.b.).

The procedure for testing for the presence of Fluorescein or Rhodamine B is similar. However, different filter combinations are used.

ANALYSIS FOR PRESENCE OF PHOSPHORUS-32 AND SULPHUR-35 RADIOISOTOPES

An aliquot of 100 to 500 ml of the filtered water sample is placed in a beaker and evaporated to dryness on a hot plate. The residue from the evaporation is then placed on a stainless steel sample pan which in turn is placed in a gas-flow internal proportional counter. This counts together the beta particle emissions from both the P-32 and S-35 isotopes. The results are recorded in counts per minute.

In certain cases, it is possible to separate the counts for P-32 and S-35. The two isotopes have different rates of decay and can, therefore, be separated by plotting the beta activity as a function of time without having to chemically separate the isotopes.

ANALYSIS FOR THE PRESENCE OF TRITIUM ISOTOPE

An aliquot of 4 ml of a previously distilled water sample is added to 20 ml of a liquid scintillation solution (a chemical solution which allows beta activity to impinge on the solution, thereby giving off flashes of light which are filtered and counted) in a 25 ml polyethylene vial. The polyethylene vial is then placed in a refrigerated liquid scintillation spectrometer (commercially available for counting tritium and carbon-14 emissions).

The light emissions caused by the interaction of the beta particles and the counting or scintillation solution are counted and compared with a standard to record their level in picocuries per litre of liquid measured.

COTTAGE POLLUTION CONTROL SURVEY

LAKE: Buckhorn 37 DATE OF SAMPLING: Aug 26/70

REPORT TO: AT: Peterborough

NOTE: X = dilution not required

SAMPLE IDENTIFICATION					LABORATORY IDENTIFICATION & REPORT		
SERIAL NO.	LOCATION EST. NO.	LOCATION CODE	SAMPLE IDENT.	NO DIL.	LAB. NO. DATE REC'D.	COLIFORM/100 ml MF TOTAL	COLIFORM/100 ml MF FAECAL
	892	1			004759 Aug 27/70	900	12
	892	2			004760	1,600	46
	892	3		X	004761	66	0
	890	1			004762	780	18
	890	2			004763	3,400	130
	890	3		X	004764	0	0
	890	4	Control		004765	700	4
	889	1			004766	1,200	16
	889	2			004767	680	12
	889	3		X	004768	80+	80+
	888	1			004769	640	20
	888	2			004770	750	16
	888	3		X	004771	80+	12
	885	1			004772	1,100	40
	885	2			004773	650	2
	885	3			004774	1,400	36
	885	4		X	004775	18	0
	884	1			004776	760	12
	884	2			004777	2k200	24
	884	3		X	004778	80+	12
	882	1			004779	3300	120
	882	2			004780	360	0
	882	3		X	004781	0	0
	882	4	Control		004782	590	0
	Community Well 379	3		X	004783	38	0
	877	3		X	004784	0	0
	874	4		X	004785	54	0
	NEGATIVE CONTROL					0	0
	POSITIVE CONTROL					8,000+	8,000+
	NEGATIVE CONTROL					0	0

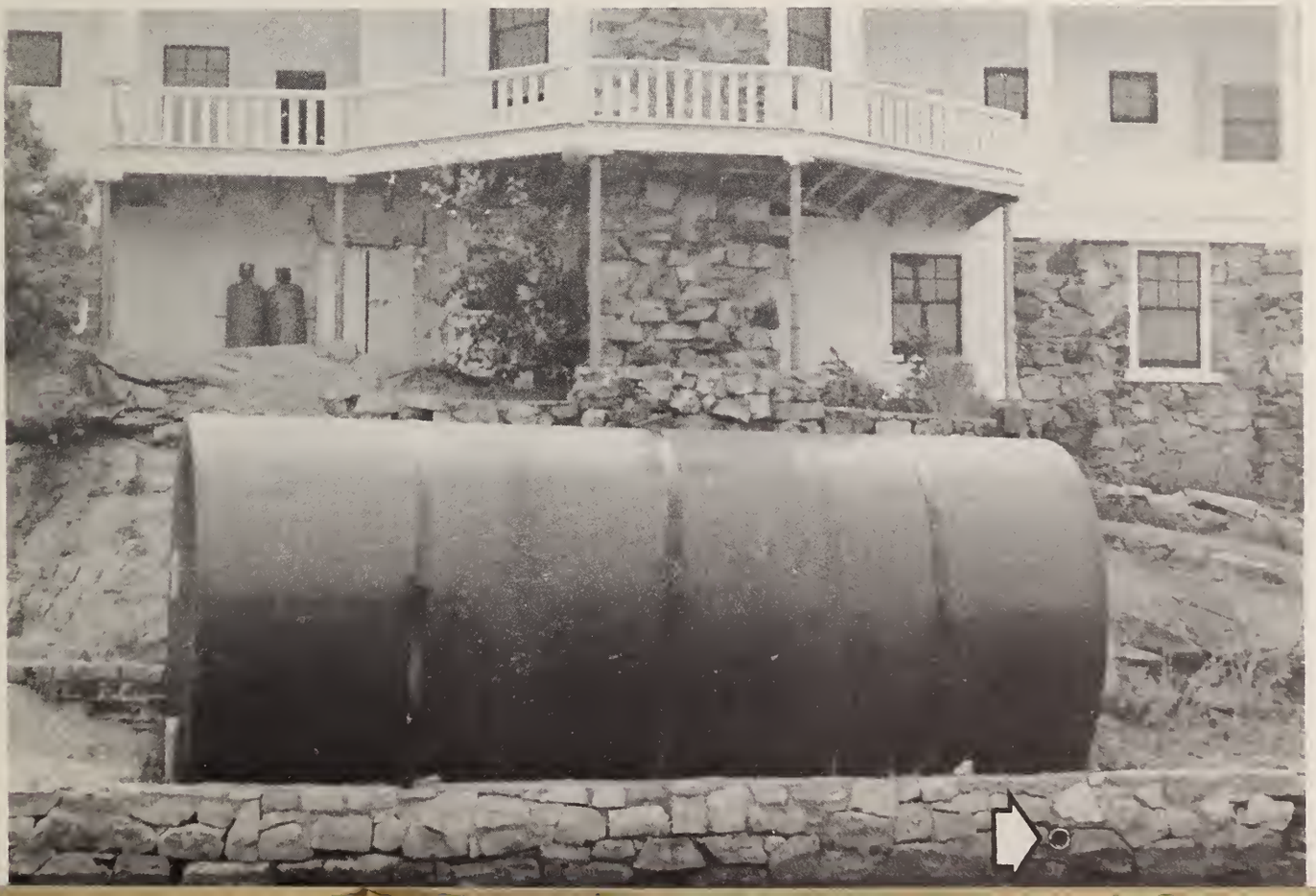
Typical Water Report Sheet

A typical public health nuisance is illustrated by this effluent pipe emptying kitchen sink water onto the ground (above).

Typical directly polluting situations are a privy built over water (below), *and effluents discharged from a drainage pipe directly into a watercourse* (opposite page, top left.)

Holding tanks may provide the answer to sewage disposal problems where septic tanks and tile fields are impractical, as in this typical Thousand Islands estate (below). *A six inch diameter pipe (arrow) discharged all waste directly into the river before inspection. The abatement advisor recommended two holding tanks - - 8,000 gal. capacity for the main house, and 2,000 gal. for the servants' quarters.*

A potential polluter is this tile bed located in a gravel area under trees ten feet from the lakeshore, in filled ground behind a timbered wall (above).



Upright tank (above) *blends in with other structures, an example of an efficient, functional installation. As well as recommending a satisfactory system, abatement advisors attempt to preserve the visual appeal of the setting.*

Pump-out barge plying the Thousand Islands (below), *was developed to serve holding tanks by water.*

TABLE 1 / DETECTION SURVEY RESULTS 1970/71

LAKE / RIVER	NUMBER OF SYSTEMS INSPECTED	CLASSIFICATION OF DETECTION RESULTS							
		SATISFACTORY (No further action indicated)		OTHER (Substandard or insufficient information)		UNSATISFACTORY (Correction required)			
						PUBLIC HEALTH NUISANCE		DIRECTLY POLLUTING	
		NO.	%	NO.	%	NO.	%	NO.	%
CLEAR	205	144	70.3	50	24.4	10	4.8	1	0.5
STONY	1,062	489	46.1	276	26.0	277	26.0	20	1.9
LOVESICK	79	35	44.3	13	16.5	23	29.1	8	10.1
BUCKHORN U.	668	552	82.6	67	10.1	37	5.5	12	1.8
BUCKHORN L.	358	248	69.3	51	14.2	50	14.0	9	2.5
CAMERON	479	360	75.1	52	10.9	56	11.7	11	2.3
BURNT RIVER	27	22	81.5	2	7.4	3	11.1	0	0.0
SPARROW	302	237	78.5	39	12.9	25	8.3	1	0.3
SMOKE	94	44	46.8	36	38.3	13	13.8	1	1.1
SOUTH TEA	55	34	61.8	8	14.5	13	23.7	0	0.0
TEPEE	63	36	57.1	11	17.5	16	25.4	0	0.0
JOE	5	0	0.0	1	20.0	4	80.0	0	0.0
LITTLE JOE	20	14	70.0	5	25.0	1	5.0	0	0.0
CANOE	94	46	48.9	34	36.2	12	12.8	2	2.1
BONITA	1	0	0.0	0	0.0	1	100.0	0	0.0
THOUSAND ISLANDS	740	479	64.7	174	23.5	25	3.4	62	8.4
CHEMONG	302	250	82.7	31	10.3	15	5.0	6	2.0
TOTALS	4,554	**2,990**	**65.6**	**850**	**18.7**	**581**	**12.8**	**133**	**2.9**

TABLE 2 / SHORELINE BACTERIOLOGICAL TEST RESULTS 1970/71

LAKE OR RIVER	NUMBER OF SYSTEMS INSPECTED	TOTAL COLIFORMS PER 100 ml. M. F.												TOTAL	
		0		1-80		81-1,000		1,001-2,400		2,401-8,000		8,000+			
		NO. OF SAMPLES AND PERCENTAGE OF TOTAL NUMBER ON LAKE													
		NO.	%	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%	NO. OF SAMPLES	%
CLEAR	205	0	0.0	170	33.9	298	59.5	24	4.8	7	1.4	2	0.4	501	100.0
STONY	1,062	39	1.9	672	32.0	1,272	60.6	92	4.4	19	0.9	5	0.2	2,099	100.0
LOVESICK	79	0	0.0	4	3.0	35	26.6	64	48.4	22	16.7	7	5.3	132	100.0
UPPER BUCKHORN	668	0	0.0	38	4.7	522	65.0	180	22.4	59	7.4	4	0.5	803	100.0
LOWER BUCKHORN	358	3	0.5	20	3.3	355	59.0	176	29.2	42	7.0	6	1.0	602	100.0
CAMERON	479	9	0.9	2	0.2	462	46.8	339	34.4	155	15.7	20	2.0	987	100.0
BURNT RIVER	27	0	0.0	0	0.0	33	64.7	16	31.4	2	3.9	0	0.0	51	100.0
SPARROW	302	33	11.0	208	69.1	47	15.6	7	2.3	4	1.3	2	0.7	301	100.0
SMOKE	94	50	19.5	170	66.4	32	12.5	0	0.0	4	1.6	0	0.0	256	100.0
SOUTH TEA	55	16	26.6	40	66.7	4	6.7	0	0.0	0	0.0	0	0.0	60	100.0
TEPEE	63	2	15.4	9	69.2	2	15.4	0	0.0	0	0.0	0	0.0	13	100.0
JOE	5	0	0.0	7	87.5	1	12.5	0	0.0	0	0.0	0	0.0	8	100.0
LITTLE JOE	20	1	12.5	3	37.5	3	37.5	1	12.5	0	0.0	0	0.0	8	100.0
CANOE	94	0	0.0	138	62.4	76	34.4	5	2.3	2	0.9	0	0.0	221	100.0
BONITA	1	1	33.3	2	66.7	0	0.0	0	0.0	0	0.0	0	0.0	3	100.0
THOUSAND ISLANDS	740	157	14.0	747	66.6	175	15.6	20	1.8	17	1.5	6	0.5	1,122	100.0
CHEMONG	302	3	0.8	48	12.2	310	79.0	23	5.9	5	1.3	3	0.8	392	100.0
TOTALS	**4,554**	**314**	**4.2**	**2,278**	**30.1**	**3,627**	**48.1**	**947**	**12.5**	**338**	**4.4**	**55**	**0.7**	**7,559**	**100.0**

TABLE 3 / SHORELINE BACTERIOLOGICAL TEST RESULTS 1970/71

LAKE OR RIVER	NUMBER OF SYSTEMS INSPECTED	FAECAL COLIFORMS PER 100 ml. M. F.												TOTAL	
		0		1-20		21-100		101-1,000		1,001-3,000		3,000+			
		NO. OF SAMPLES AND PERCENTAGE OF TOTAL NUMBER ON LAKE													
		NO.	%	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%	NO. OF SAMPLES	%
CLEAR	205	203	40.6	172	34.2	95	19.0	29	5.8	1	0.2	1	0.2	501	100.0
STONY	1,062	946	45.1	711	33.9	355	16.9	80	3.8	3	0.1	4	0.2	2,099	100.0
LOVESICK	79	24	18.2	38	28.8	34	25.8	30	22.6	5	3.8	1	0.8	132	100.0
UPPER BUCKHORN	668	200	24.8	281	35.0	243	30.3	72	9.0	4	0.5	3	0.4	803	100.0
LOWER BUCKHORN	358	171	28.4	187	31.1	168	27.9	68	11.2	4	0.7	4	0.7	602	100.0
CAMERON	479	215	21.8	299	30.3	287	29.1	165	16.7	12	1.2	9	0.9	987	100.0
BURNT RIVER	27	3	5.9	14	27.4	30	58.9	4	7.8	0	0.0	0	0.0	51	100.0
SPARROW	302	100	33.2	132	43.8	47	15.6	17	5.7	2	0.7	3	1.0	301	100.0
SMOKE	94	143	55.9	92	35.9	13	5.1	8	3.1	0	0.0	0	0.0	256	100.0
SOUTH TEA	55	32	53.3	22	36.7	6	10.0	0	0.0	0	0.0	0	0.0	60	100.0
TEPEE	63	4	30.8	9	69.2	0	0.0	0	0.0	0	0.0	0	0.0	13	100.0
JOE	5	1	12.5	7	87.5	0	0.0	0	0.0	0	0.0	0	0.0	8	100.0
LITTLE JOE	20	1	12.5	4	50.0	2	25.0	1	12.5	0	0.0	0	0.0	8	100.0
CANOE	94	54	24.4	119	53.9	39	17.6	8	3.6	1	0.5	0	0.0	221	100.0
BONITA	1	3	100.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	3	100.0
THOUSAND ISLANDS	740	486	43.4	380	33.8	225	20.0	27	2.4	3	0.3	1	0.1	1,122	100.0
CHEMONG	302	141	35.9	153	39.1	71	18.1	23	5.9	4	1.0	0	0.0	392	100.0
TOTALS	**4,554**	**2,727**	**36.1**	**2,620**	**34.7**	**1,615**	**21.4**	**532**	**7.0**	**39**	**0.5**	**26**	**0.3**	**7,559**	**100.0**

TABLE 4 / CHEMICAL TEST RESULTS 1970/71

LAKE OR RIVER	NUMBER OF SAMPLES TAKEN	CHEMICAL TEST RESULTS OF INLETS AND OUTLETS (P.P.M.)												NUMBER OF TESTS MADE
		NITRATE (N)					PHOSPHATE (PO_4)				A.B.S. (M.B.A.)			
		⩽0.10	0.11 to 0.40	0.41 to 0.99	1.00 to 10.0	>10.0	⩽0.025	0.026 to 0.099	0.10 to 0.50	>0.50	⩽0.025	0.026 to 0.10	>0.10	
LOWER BUCKHORN	2	2					2				2			6
CAMERON	41	41					40	1			41			123
CANOE	16	16					8	2	6		15		1	48
CLEAR	31	19	1	9		2	19	9	3		19	11	1	93
SMOKE	20	19		1			17	3			20			60
SOUTH TEA	8	8					8				8			24
SPARROW	40	38	1		1		26	8	6		40			120
STONY	40	19	3	16	1		21	11	7	1	20	20		119
THOUSAND ISLANDS	40	40					7	10	20	3	40			120
TOTALS	**238**	**202**	**5**	**26**	**2**	**2**	**148**	**44**	**42**	**4**	**205**	**31**	**2**	**713**

TABLE 5 / CHEMICAL TEST RESULTS / SPECIAL STUDY – CAMERON LAKE 1970/71

NUMBER OF SAMPLES TAKEN	CHEMICAL TEST RESULTS OF INLETS AND OUTLETS (P.P.M.)																	NUMBER OF TESTS MADE
	FREE AMMONIA (N)		NITRITE (N)			NITRATE (N)				PHOSPHATE (PO_4)			A.B.S. (M.B.A.)			CHLORIDES		AMMONIA (ALB)		
	⩽0.001	0.002 to 0.009	⩽0.001	0.002 to 0.009	0.010 to 0.10	⩽0.10	0.11 to 0.40	0.41 to 0.99	1.00 to 10.0	⩽0.025	0.026 to 0.099	0.10 to 0.49	⩽0.025	0.026 to 0.099	⩾0.10	⩽10	11 to 50	>50	⩽0.015	0.016 to 0.10	
43	**36**	**7**	**41**	**2**		**43**				**42**	**1**		**43**			**43**			**26**	**17**	**301**

TABLE 6 / SUMMARY OF ABATEMENT 1970/71 / Period covered — Oct. 1970 to March 1971

REGION	LAKE	OWNERS NOTIFIED			AGREEMENTS						WORK REPORTED COMPLETE BY OWNER
					PREPARED			SIGNED			
		PHN	DIRECTLY POLLUTING	TOTAL	PHN	DIRECTLY POLLUTING	TOTAL	PHN	DIRECTLY POLLUTING	TOTAL	PHN
KAWARTHAS	CLEAR	14	1	15	8	1	9	6	0	6	
	STONY	234	20	254	107	9	116	80	8	88	8
	LOVESICK	20	5	25	0	0	0	0	0	0	2
	U. BUCKHORN	29	8	37	9	1	10	7	1	8	3
	L. BUCKHORN	58	5	63	28	1	29	24	1	25	
	CHEMONG	18	9	27	4	1	5	1	0	1	
	CAMERON	54	12	66	27	2	29	12	2	14	8
	BURNT RIVER	3	0	3	0	0	0	0	0	0	
MUSKOKA	SPARROW	7	1	8	5	1	6	2	0	2	
ST. LAWRENCE	THOUSAND ISLANDS	ST. LAWRENCE — WORK SCHEDULED TO START APRIL 1, 1971									
ALGONQUIN	SOUTH TEA CANOE JOE & L. JOE TEPEE SMOKE BONITA	ALGONQUIN — Assistance being given in this area by Northern Ontario Public Health Service. Work scheduled to start July 1, 1971									
TOTALS		**437**	**61**	**498**	**188**	**16**	**204**	**132**	**12**	**144**	**21**

PHN — PUBLIC HEALTH NUISANCE

CHEMICAL TEST RESULTS / INLETS AND OUTLETS / SPARROW LAKE 1970

MAP NO.	LOCATION CODE	SAMPLE NO.	NITRATE (N) P.P.M.	PHOSPHATE (PO_4) P.P.M.	A.B.S. (M.B.A.) P.P.M.
70-06	C_1	1	<0.1	N.D.	<0.025
		2	<0.1	<0.1	<0.025
		3	<0.1	<0.01	<0.025
		4	<0.1	<0.01	<0.025
	C_2	1	0.2	N.D.	<0.025
		2	<0.1	N.D.	<0.025
		3	<0.1	<0.01	<0.025
		4	<0.1	<0.01	<0.025
	C_3	1	<0.1	<0.1	<0.025
		2	<0.1	N.D.	<0.025
		3	<0.1	<0.01	<0.025
		4	<0.1	<0.01	<0.025
	C_4	1	<0.1	N.D.	<0.025
		2	<0.1	N.D.	<0.025
		3	<0.1	<0.01	<0.025
		4	<0.1	<0.01	<0.025
	C_5	1	<0.1	<0.1	<0.025
		2	<0.1	<0.1	<0.025
		3	<0.1	<0.01	<0.025
		4	<0.1	<0.01	<0.025
	C_6	1	<0.1	<0.1	<0.025
		2	<0.1	<0.1	<0.025
		3	<0.1	<0.01	<0.025
		4	<0.1	<0.01	<0.025
	C_7	1	<0.1	<0.1	<0.025
		2	<0.1	0.2	<0.025
		3	<0.1	<0.01	<0.025
		4	<0.1	<0.01	<0.025
	C_8	1	<0.1	0.2	<0.025
		2	<0.1	<0.1	<0.025
		3	<0.1	<0.01	<0.025
		4	<0.1	<0.01	<0.025
	C_9	1	1.8	0.3	<0.025
		2	<0.1	0.1	<0.025
		3	<0.1	0.15	<0.025
		4	<0.1	<0.01	<0.025
	C_{10}	1	<0.1	N.D.	<0.025
		2	<0.1	N.D.	<0.025
		3	<0.1	0.12	<0.025
		4	<0.1	<0.01	<0.025

N.D. – NONE DETECTED.
CODE NO. – REFERS TO INLET OR OUTLET AS SHOWN ON MAP NUMBER 70 - 06.

CHEMICAL TEST RESULTS / INLETS AND OUTLETS / SMOKE LAKE / 1970

MAP NO.	LOCATION CODE	SAMPLE NO.	NITRATE (N) P.P.M.	PHOSPHATE (PO_4) P.P.M.	A.B.S. (M.B.A.) P.P.M.
70-05	C_1	1	<0.1	<0.1	<0.025
		2	<0.1	N.D.	<0.025
	C_2	1	<0.1	N.D.	<0.025
		2	<0.1	N.D.	<0.025
	C_3	1	<0.1	N.D.	<0.025
		2	<0.1	N.D.	<0.025
	C_4	1	<0.1	N.D.	<0.025
		2	<0.1	N.D.	<0.025
	C_5	1	<0.1	<0.1	<0.025
		2	<0.1	N.D.	<0.025
	C_6	1	0.1	<0.1	<0.025
		2	<0.1	N.D.	<0.025
	C_7	1	<0.1	N.D.	<0.025
		2	<0.1	N.D.	<0.025
	C_8	1	<0.1	N.D.	<0.025
		2	<0.1	N.D.	<0.025
	C_9	1	0.1	N.D.	<0.025
		2	<0.1	N.D.	<0.025
	C_{10}	1	<0.1	N.D.	<0.025
		2	0.5	N.D.	<0.025

N.D. – NONE DETECTED.
CODE NO. – REFERS TO INLET OR OUTLET AS SHOWN ON MAP NUMBER 70 - 05.

CHEMICAL TEST RESULTS / INLETS AND OUTLETS / CANOE LAKE / 1970

MAP NO.	LOCATION CODE	SAMPLE NO.	NITRATE (N) P.P.M.	PHOSPHATE (PO_4) P.P.M.	A.B.S. (M.B.A.) P.P.M.
70-05	C_1	1	<0.1	N.D.	<0.025
		2	<0.1	0.2	<0.025
	C_2	1	<0.1	N.D.	<0.025
		2	<0.1	N.D.	<0.025
	C_3	1	<0.1	N.D.	<0.025
		2	<0.1	N.D.	<0.025
	C_4	1	0.1	0.1	<0.025
		2	0.1	N.D.	<0.025
	C_5	1	<0.1	0.1	<0.025
		2	<0.1	0.1	<0.025
	C_6	1	<0.1	<0.1	<0.025
		2	<0.1	<0.1	<0.025
	C_7	1	<0.1	N.D.	<0.025
		2	<0.1	0.1	<0.025
	C_8	1	<0.1	N.D.	0.15
		2	<0.1	0.2	<0.025

N.D. – NONE DETECTED.
CODE NO. – REFERS TO INLET OR OUTLET AS SHOWN ON MAP NUMBER 70 - 05.

CHEMICAL TEST RESULTS / INLETS AND OUTLETS / THOUSAND ISLANDS / 1970

MAP NO.	LOCATION CODE	SAMPLE NO.	NITRATE (N) P.P.M.	PHOSPHATE (PO_4) P.P.M.	A.B.S. (M.B.A.) P.P.M.
70-04	C_1	1	<0.1	0.4	<0.025
		2	<0.1	0.1	<0.025
		3	0.1	0.6	<0.025
		4	<0.1	0.1	<0.025
	C_2	1	<0.1	<0.1	<0.025
		2	<0.1	0.3	<0.025
		3	<0.1	<0.1	<0.025
		4	<0.1	N.D.	<0.025
	C_3	1	<0.1	<0.1	<0.025
		2	<0.1	0.3	<0.025
		3	<0.1	0.3	<0.025
		4	<0.1	0.2	<0.025
	C_4	1	<0.1	0.4	<0.025
		2	<0.1	<0.1	<0.025
		3	0.1	0.4	<0.025
		4	<0.1	N.D.	<0.025
	C_5	1	<0.1	0.1	<0.025
		2	<0.1	0.1	<0.025
		3	<0.1	0.1	<0.025
		4	<0.1	0.2	<0.025
		5	<0.1	0.145	<0.025
		6	<0.1	0.120	<0.025
	C_6	1	<0.1	<0.1	<0.025
		2	<0.1	<0.1	<0.025
		3	<0.1	N.D.	<0.025
		4	<0.1	0.2	<0.025
		5	<0.1	0.030	<0.025
		6	<0.1	0.03	<0.025
	C_7	1	<0.1	0.1	<0.025
		2	<0.1	0.1	<0.025
		3	<0.1	N.D.	<0.025
		4	<0.1	N.D.	<0.025
		5	<0.1	0.08	<0.025
		6	<0.1	<0.01	<0.025
	C_8	1	<0.1	0.6	<0.025
		2	<0.1	<0.1	<0.025
		3	0.1	0.5	<0.025
		4	<0.1	0.2	<0.025
		5	<0.1	0.14	<0.025
		6	<0.1	<0.01	<0.025

CHEMICAL TEST RESULTS / INLETS AND OUTLETS / SOUTH TEA LAKE / 1970

MAP NO.	LOCATION CODE	SAMPLE NO.	NITRATE (N) P.P.M.	PHOSPHATE (PO_4) P.P.M.	A.B.S. (M.B.A.) P.P.M.
70-05	C_1	1	<0.1	N.D.	<0.025
		2	<0.1	N.D.	<0.025
	C_2	1	<0.1	N.D.	<0.025
		2	<0.1	N.D.	<0.025
	C_3	1	<0.1	N.D.	<0.025
		2	<0.1	N.D.	<0.025
	C_4	1	<0.1	N.D.	<0.025
		2	<0.1	N.D.	<0.025

N.D. – NONE DETECTED.
CODE NO. – REFERS TO INLET OR OUTLET AS SHOWN ON MAP NUMBER 70 - 05.

CHEMICAL TEST RESULTS / INLETS AND OUTLETS / CAMERON LAKE / 1970

MAP NO.	LOCATION CODE	SAMPLE NO.	NITRATE (N) P.P.M.	PHOSPHATE (PO_4) P.P.M.	A.B.S. (M.B.A.) P.P.M.
70-03	C_1	1	<0.1	N.D.	<0.025
		2	<0.1	N.D.	<0.025
		3	<0.1	N.D.	<0.025
		4	<0.1	N.D.	<0.025
		5	<0.1	N.D.	<0.025
		6	<0.1	N.D.	<0.025
		7	<0.1	N.D.	<0.025
		8	<0.1	N.D.	<0.025
		9	<0.1	N.D.	<0.025
		10	<0.1	N.D.	<0.025
	C_2	1	<0.1	N.D.	<0.025
		2	<0.1	N.D.	<0.025
		3	<0.1	N.D.	<0.025
		4	<0.1	N.D.	<0.025
	C_3	1	<0.1	N.D.	<0.025
		2	<0.1	N.D.	<0.025
		3	<0.1	N.D.	<0.025
		4	<0.1	N.D.	<0.025
		5	<0.1	N.D.	<0.025
		6	<0.1	N.D.	<0.025
		7	<0.1	N.D.	<0.025
		8	<0.1	N.D.	<0.025
		9	<0.1	N.D.	<0.025
		10	<0.1	N.D.	<0.025
		11	<0.1	N.D.	<0.025
	C_4	1	<0.1	<0.1	<0.025
		2	<0.1	N.D.	<0.025
		3	<0.1	N.D.	<0.025
		4	<0.1	N.D.	<0.025
		5	<0.1	N.D.	<0.025
		6	<0.1	N.D.	<0.025
	C_5	1	<0.1	N.D.	<0.025
		2	<0.1	N.D.	<0.025
		3	<0.1	N.D.	<0.025
		4	<0.1	N.D.	<0.025
	C_6	1	<0.1	N.D.	<0.025
		2	<0.1	N.D.	<0.025
		3	<0.1	N.D.	<0.025
	C_7	1	<0.1	N.D.	<0.025
		2	<0.1	N.D.	<0.025
		3	<0.1	N.D.	<0.025

N.D. – NONE DETECTED.
CODE NO. – REFERS TO INLET OR OUTLET AS SHOWN ON MAP NUMBER 70 - 03.

CHEMICAL TEST RESULTS / INLETS AND OUTLETS / LOWER BUCKHORN LAKE / 1970

MAP NO.	LOCATION CODE	SAMPLE NO.	NITRATE (N) P.P.M.	PHOSPHATE (PO_4) P.P.M.	A.B.S. (M.B.A.) P.P.M.
70-02	C_1	1	<0.1	N.D.	<0.025
	C_2	1	<0.1	N.D.	<0.025

CHEMICAL TEST RESULTS / INLETS AND OUTLETS / CLEAR LAKE / 1970

MAP NO.	LOCATION CODE	SAMPLE NO.	NITRATE (N) P.P.M.	PHOSPHATE (PO_4) P.P.M.	A.B.S. (M.B.A.) P.P.M.
70-01	C_1	1	14.4	N.D.	0.100
		2	0.7	N.D.	<0.100
		3	0.6	<0.1	<0.100
		4	11.5	N.D.	<0.025
		5	<0.1	N.D.	<0.025
		6	<0.1	<0.1	<0.025
		7	<0.1	<0.1	<0.025
		8	<0.1	0.2	<0.025
	C_2	1	0.9	N.D.	<0.100
		2	0.8	N.D.	0.050
		3	<0.1	N.D.	<0.025
	C_3	1	<0.1	N.D.	0.025
		2	<0.1	N.D.	<0.025
		3	<0.1	<0.1	<0.025
		4	<0.1	N.D.	<0.025
	C_4	1	<0.1	N.D.	<0.025
		2	<0.1	N.D.	0.038
		3	<0.1	<0.1	<0.025
		4	<0.1	N.D.	<0.025
	C_5	1	0.5	N.D.	<0.100
		2	0.4	<0.1	<0.100
		3	<0.1	N.D.	<0.025
		4	<0.1	N.D.	<0.025

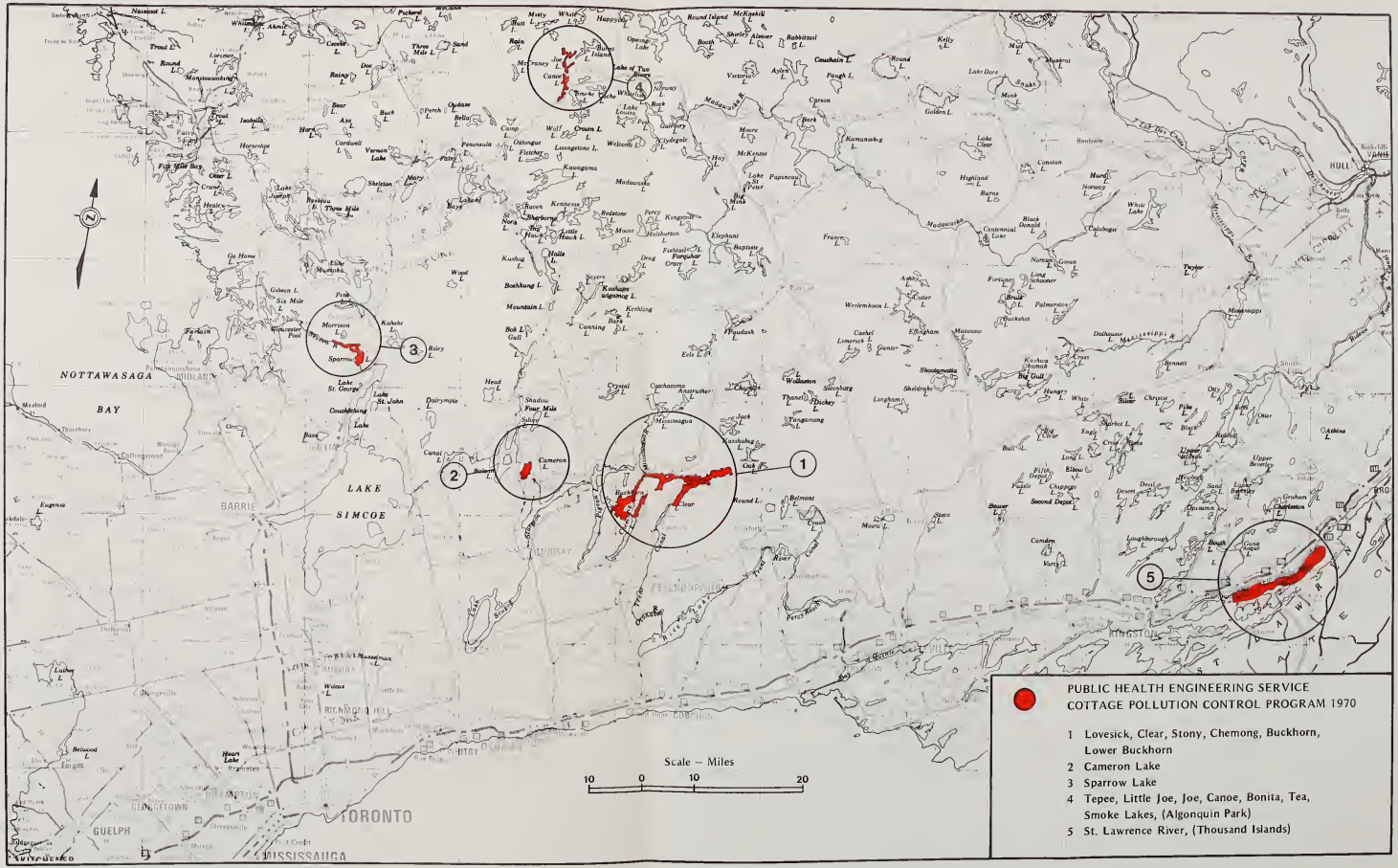
N.D. – NONE DETECTED.
CODE NO. – REFERS TO INLET OR OUTLET AS SHOWN ON MAP NUMBER 70 - 01.

CHEMICAL TEST RESULTS / INLETS AND OUTLETS / STONY LAKE / 1970

MAP NO.	LOCATION CODE	SAMPLE NO.	NITRATE (N) P.P.M.	PHOSPHATE (PO_4) P.P.M.	A.B.S. (M.B.A.) P.P.M.
70-01	C_1	1	0.5	<0.1	<0.100
		2	0.5	N.D.	<0.100
		3	<0.1	N.D.	<0.025
		4	<0.1	<0.1	<0.025
		5	<0.1	0.2	<0.025
	C_2	1	0.6	N.D.	<0.100
		2	0.5	0.2	<0.100
		3	<0.1	<0.1	<0.025
		4	<0.1	0.1	<0.025
		5	–	0.1	<0.025
	C_3	1	0.6	0.2	<0.100
		2	0.5	N.D.	<0.100
	C_4	1	0.6	<0.1	<0.100
		2	1.0	0.7	<0.100
	C_5	1	0.6	<0.1	<0.100
		2	0.5	<0.1	<0.100
		3	<0.1	N.D.	<0.025
		4	<0.1	N.D.	<0.025
		5	<0.1	<0.1	<0.025
		6	<0.1	N.D.	<0.025
		7	<0.1	N.D.	<0.025
		8	<0.1	N.D.	<0.025
		9	<0.1	<0.1	<0.025
	C_6	1	0.7	N.D.	<0.100
		2	0.4	N.D.	<0.100
		3	<0.1	N.D.	<0.025
	C_7	1	0.6	N.D.	<0.100
		2	0.8	<0.1	<0.100
	C_8	1	0.7	N.D.	<0.100
		2	0.8	0.2	<0.100
		3	<0.1	N.D.	<0.025
		4	<0.1	N.D.	<0.025
		5	<0.1	N.D.	<0.025
		6	<0.1	N.D.	<0.025
	C_9	1	0.5	N.D.	<0.100
		2	0.4	0.2	<0.100
		3	<0.1	<0.1	<0.025
		4	<0.1	<0.1	<0.025
	C_{10}	1	0.6	N.D.	<0.100
		2	0.4	N.D.	<0.100

N.D. – NONE DETECTED.
CODE NO. – REFERS TO INLET OR OUTLET AS SHOWN ON MAP NUMBER 70-01.

MAPS AND CHARTS


PUBLIC HEALTH ENGINEERING SERVICE
COTTAGE POLLUTION CONTROL PROGRAM 1970
1 Lovesick, Clear, Stony, Chemong, Buckhorn, Lower Buckhorn
2 Cameron Lake
3 Sparrow Lake
4 Tepee, Little Joe, Joe, Canoe, Bonita, Tea, Smoke Lakes, (Algonquin Park)
5 St. Lawrence River, (Thousand Islands)
Scale – Miles
10 0 10 20
NOTTAWASAGA BAY
LAKE SIMCOE
TORONTO
MISSISSAUGA
GUELPH
KINGSTON
HULL

FOR CONTINUATION SEE MAP 70-02

LOVESICK LAKE
LOWER BUCKHORN LAKE
BURLEIGH FALLS
SMITH TAP LAKE
CLEAR LAKE
STONY LAKE
MOUNT JULIAN
McCRACKENS LANDING
DUMMER LAKE (Indian River)
STONYRIDGE
COUNTY ROAD
Burleigh Falls Trail
Smith Tap Portage
Trail to Camp

SHORELINE BACTERIOLOGICAL RESULTS

	TOTAL No. SAMPLES	No. OF SAMPLES IN RANGE OF:			
		0 – 100	101 – 1000	1001 – 2400	> 2400
TOTAL COLIFORM	2732	2490		180	62
FAECAL COLIFORM	2732	2578	139	9	6

LEGEND

ROADS
RIVERS OR STREAMS
TOWNSHIP BOUNDARY
POLLUTER
PUBLIC HEALTH NUISANCE
CHEMICAL SAMPLE (SEE TABLE FOR RESULTS) (C3)
TOTAL COLIFORM GREATER THAN (>) 2400 (TWO SAMPLES) A7
FAECAL COLIFORM GREATER THAN (>) 100 (SIX SAMPLES) A6

NOTE 10/5 THIS MEANS THAT IN THE OUTLINED AREA THERE ARE 10 SHORELINE ESTABLISHMENTS OF WHICH 5 WERE SURVEYED IN 1970.

SCALE IN MILES

ONTARIO DEPARTMENT OF HEALTH
PUBLIC HEALTH ENGINEERING SERVICE

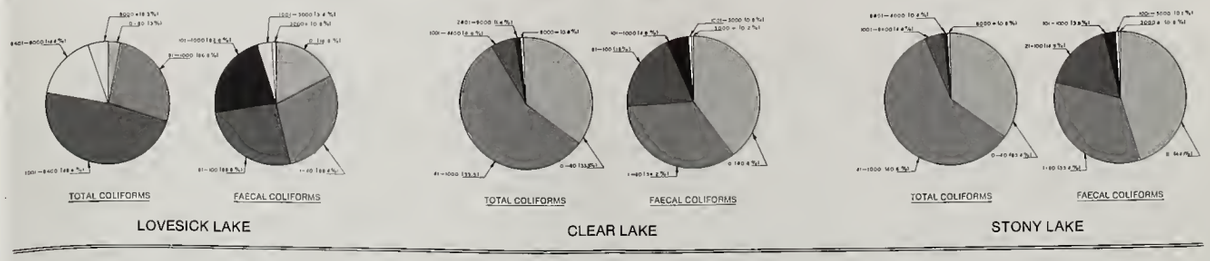
KAWARTHA LAKES AREA

LOVESICK, CLEAR AND STONY LAKES

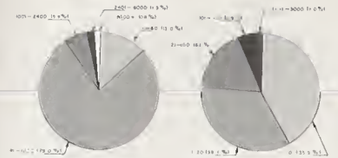
COTTAGE POLLUTION CONTROL PROGRAM
1970 — 71

HARVEY TOWNSHIP , BURLEIGH TOWNSHIP, SMITH TOWNSHIP, DOURO TOWNSHIP, AND DUMMER TOWNSHIP

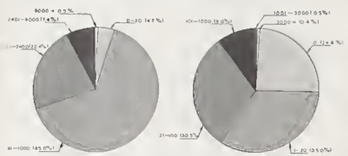
MARCH 31, 1971 | MAP 70-01



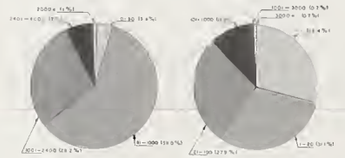
Shoreline Bacteriological Sample Results
KAWARTHA LAKES AREA



CHEMONG LAKE



BUCKHORN LAKE



LOWER BUCKHORN LAKE

Shoreline Bacteriological
Sample Results

KAWARTHA LAKES AREA

LEGEND

ROADS

RIVERS OR STREAMS

TOWNSHIP BOUNDARY

POLLUTER ●

PUBLIC HEALTH NUISANCE ■

CHEMICAL SAMPLE (SEE TABLE FOR RESULTS) (C2)

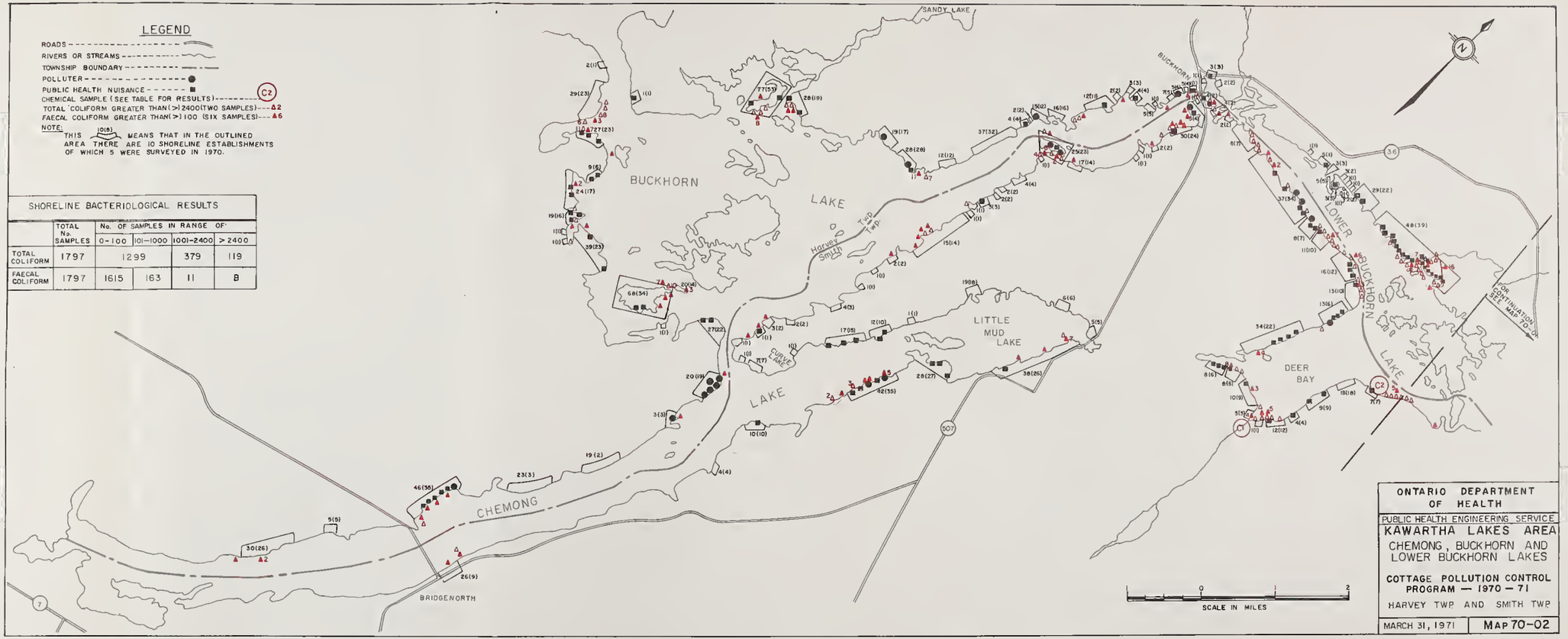
TOTAL COLIFORM GREATER THAN (>) 2400 (TWO SAMPLES) ▲2

FAECAL COLIFORM GREATER THAN (>) 100 (SIX SAMPLES) ▲6

NOTE:
THIS (10(8)) MEANS THAT IN THE OUTLINED AREA THERE ARE 10 SHORELINE ESTABLISHMENTS OF WHICH 5 WERE SURVEYED IN 1970.

SHORELINE BACTERIOLOGICAL RESULTS

	TOTAL No. SAMPLES	No. OF SAMPLES IN RANGE OF:			
		0-100	101-1000	1001-2400	> 2400
TOTAL COLIFORM	1797	1299		379	119
FAECAL COLIFORM	1797	1615	163	11	8



ONTARIO DEPARTMENT OF HEALTH

PUBLIC HEALTH ENGINEERING SERVICE

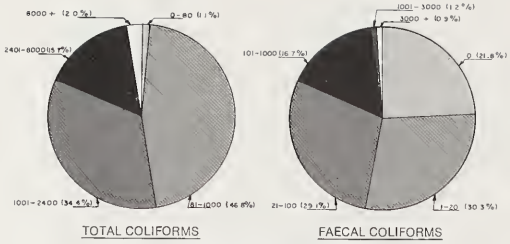
KAWARTHA LAKES AREA

CHEMONG, BUCKHORN AND LOWER BUCKHORN LAKES

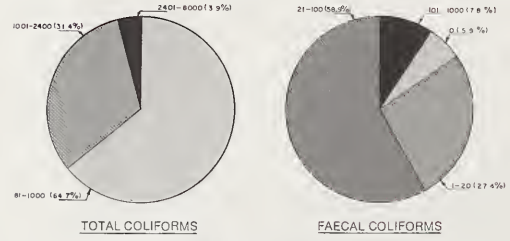
COTTAGE POLLUTION CONTROL PROGRAM — 1970 — 71

HARVEY TWP. AND SMITH TWP.

MARCH 31, 1971 | MAP 70-02



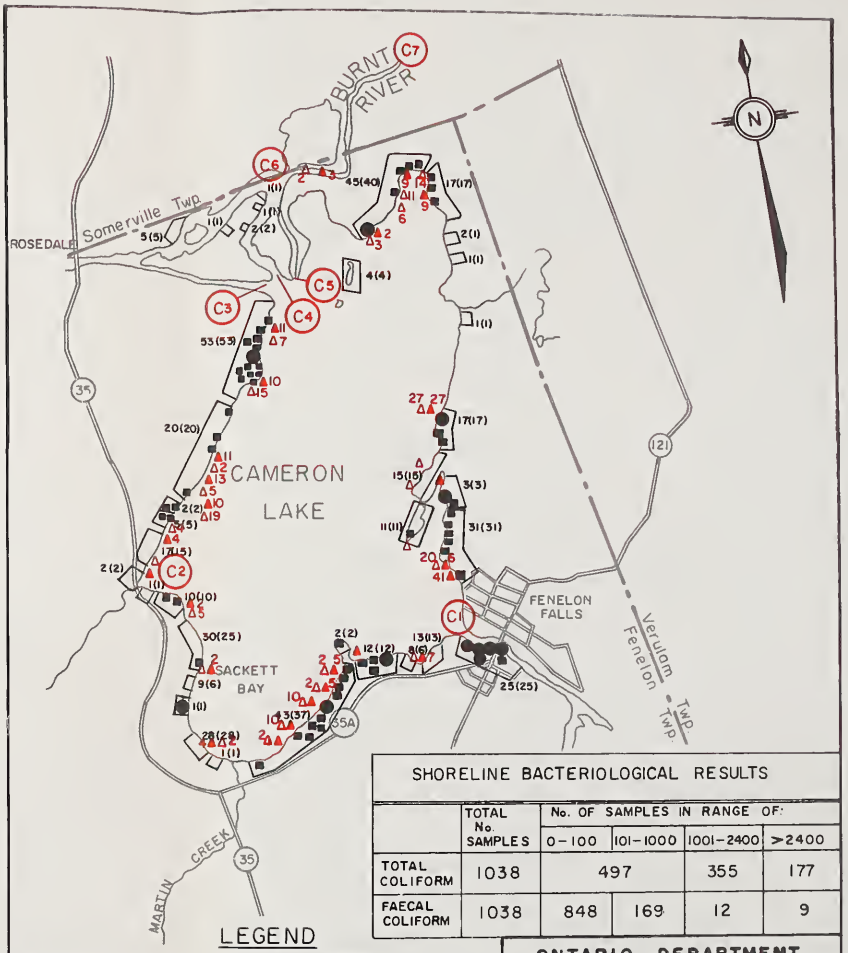
CAMERON LAKE



BURNT RIVER

Shoreline Bacteriological
Sample Results

KAWARTHA LAKES AREA



LEGEND

ROADS ----------

RIVERS OR STREAMS ----------

TOWNSHIP BOUNDARY ----------

POLLUTER ----------●

PUBLIC HEALTH NUISANCE ----------■

CHEMICAL SAMPLE (SEE TABLE FOR RESULTS) ---------- C3

TOTAL COLIFORM GREATER THAN (>) 2400 (TWO SAMPLES) ---▲2

FAECAL COLIFORM GREATER THAN (>) 100 (SIX SAMPLES) ---▲6

NOTE: 10(5) THIS MEANS THAT IN THE OUTLINED AREA THERE ARE 10 SHORELINE ESTABLISHMENTS OF WHICH 5 WERE SURVEYED IN 1970

SHORELINE BACTERIOLOGICAL RESULTS

	TOTAL No. SAMPLES	No. OF SAMPLES IN RANGE OF:			
		0-100	101-1000	1001-2400	>2400
TOTAL COLIFORM	1038	497		355	177
FAECAL COLIFORM	1038	848	169	12	9

ONTARIO DEPARTMENT OF HEALTH

PUBLIC HEALTH ENGINEERING SERVICE

KAWARTHA LAKES AREA

CAMERON LAKE AND BURNT RIVER

COTTAGE POLLUTION CONTROL PROGRAM — 1970 — 71

FENELON TOWNSHIP

MARCH 31, 1971 | MAP 70-03

ST. LAWRENCE RIVER

Shoreline Bacteriological Sample Results

THOUSAND ISLANDS AREA

SHORELINE BACTERIOLOGICAL RESULTS					
	TOTAL No. SAMPLES	No. OF SAMPLES IN RANGE OF			
		0-100	101-1000	1001-2400	>2400
TOTAL COLIFORM	1122	1079		20	23
FAECAL COLIFORM	1122	605	27	3	1

LEGEND

ROADS
RIVERS OR STREAMS
TOWNSHIP BOUNDARY
INTERNATIONAL BOUNDARY
POLLUTER
PUBLIC HEALTH NUISANCE
CHEMICAL SAMPLE (SEE TABLE FOR RESULTS) — C2
TOTAL COLIFORM GREATER THAN (>) 2400 (TWO SAMPLES) — Δ2
FAECAL COLIFORM GREATER THAN (>) 100 (SIX SAMPLES) — Δ6

NOTE: THIS (10|5) MEANS THAT IN THE OUTLINED AREA THERE ARE 10 SHORELINE ESTABLISHMENTS OF WHICH 5 WERE SURVEYED IN 1970

ONTARIO DEPARTMENT OF HEALTH

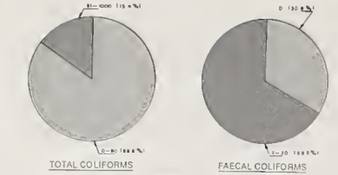
PUBLIC HEALTH ENGINEERING SERVICE

THOUSAND ISLANDS AREA
ST. LAWRENCE RIVER

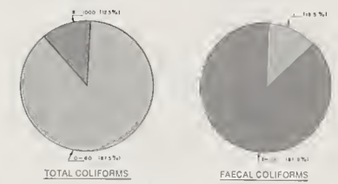
COTTAGE POLLUTION CONTROL PROGRAM — 1970 — 71

FRONT OF ESCOTT & YONGE TOWNSHIPS AND FRONT OF LEEDS AND LANSDOWNE TWP

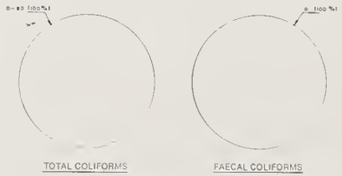
MARCH 31, 1971 | MAP 70-04



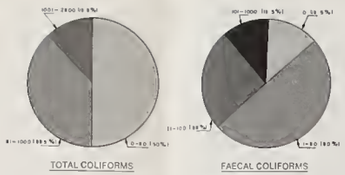
TEPEE LAKE



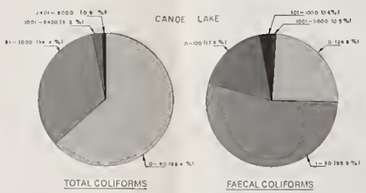
JOE LAKE



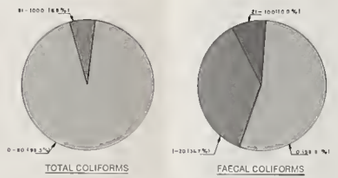
BONITA LAKE



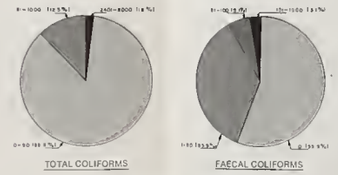
LITTLE JOE LAKE



CANOE LAKE



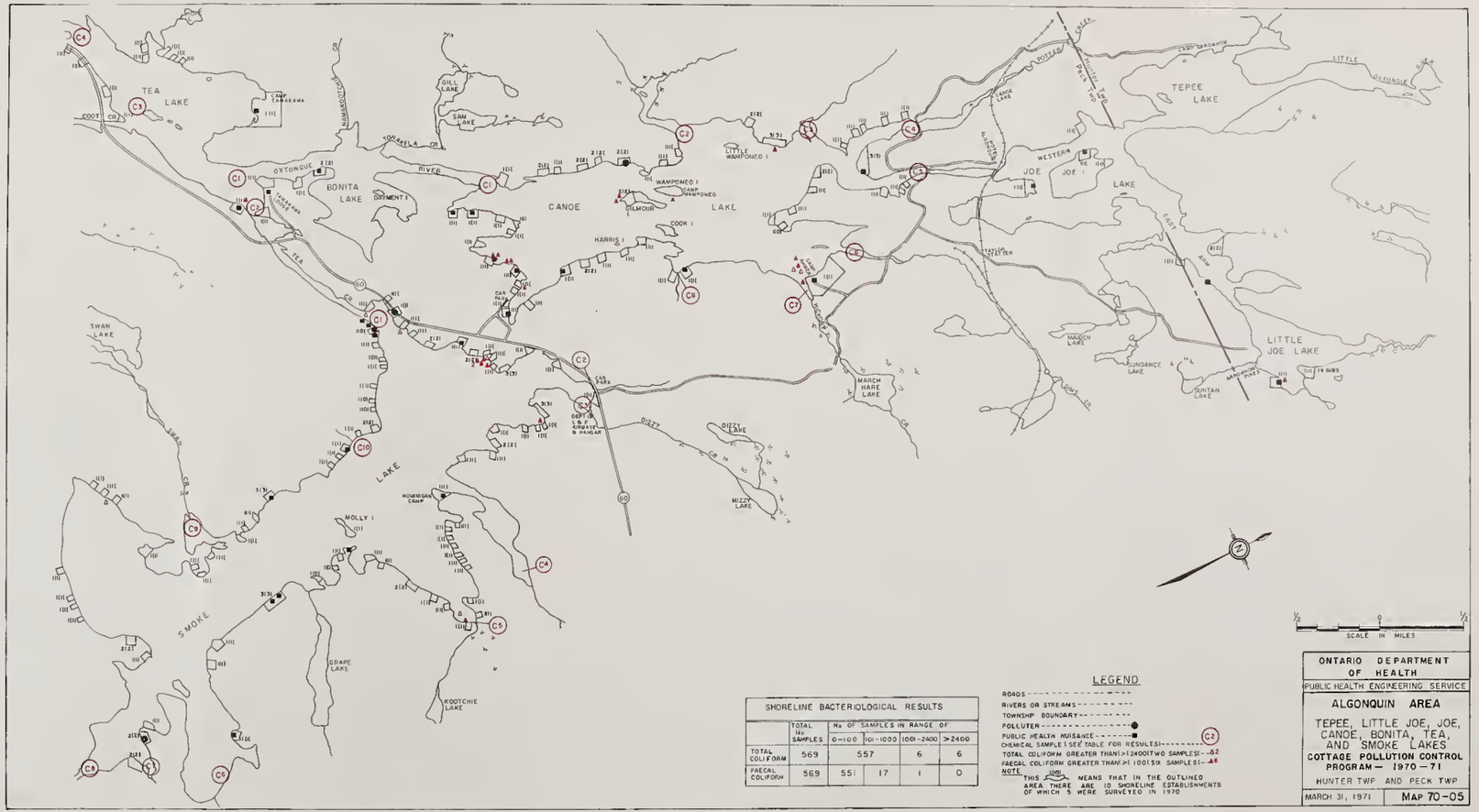
TEA LAKE

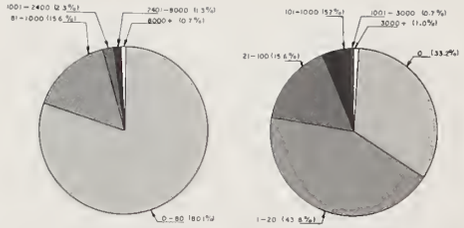


SMOKE LAKE

Shoreline Bacteriological
Sample Results

ALGONQUIN AREA


TEA LAKE
CAMP TAMARAMA
GULL LAKE
SAN LAKE
BONITA LAKE
OXTONGUE RIVER
CANOE LAKE
WAMPOMEO I
CAMP WAMPOMEO
LITTLE WAMPOMEO I
HARRIS I
COOK I
GILMOUR I
DAYMENT I
SWAN LAKE
MOHENDAN CAMP
MOLLY I
SMOKE LAKE
GRAPE LAKE
KOOTCHIE LAKE
DIZZY LAKE
MIZZY LAKE
MARCH HARE LAKE
TEPEE LAKE
LITTLE OXTONGUE
WESTERN JOE LAKE
EAST JOE LAKE
MAUDIN LAKE
SUNDANCE LAKE
SANTAN LAKE
LITTLE JOE LAKE
CAMP KAWAGAMA
CAMP KAMAKWIN
CAMP KAMAKWIN
CAMP KAMAKWIN



SPARROW LAKE

Shoreline Bacteriological
Sample Results

MUSKOKA AREA

SHORELINE BACTERIOLOGICAL RESULTS

	TOTAL No. SAMPLES	No. OF SAMPLES IN RANGE OF:			
		0–100	101–1000	1001–2400	> 2400
TOTAL COLIFORM	301	288		7	6
FAECAL COLIFORM	301	279	17	2	3

SPARROW LAKE (PORT STANTON P.O.)

Matchedash Twp.

Orillia Twp.

WEST BAY

MARIE I.

DUQUESNE I.

McLEAN BAY

CARL I.

EVANS I.

FITTON I.

CHANNEL I.

County of Simcoe
District of Muskoka – Morrison Twp.

HAMLET

SPARROW LAKE

HIGH I.

McCORMICK I.

JOHN I.

PAUL I.

MARGARET I.

SPEER I.

ERNEST I.

JEVINS CR.

SPARROW LAKE P.O.

C1 C2 C3 C4 C5 C6 C7 C8 C9 C10

LEGEND

ROADS

RIVERS OR STREAMS

TOWNSHIP BOUNDARY

COUNTY BOUNDARY

POLLUTER

PUBLIC HEALTH NUISANCE

CHEMICAL SAMPLE (SEE TABLE FOR RESULTS) C2

TOTAL COLIFORM GREATER THAN(>)2400(TWO SAMPLES) Δ2

FAECAL COLIFORM GREATER THAN(>) 100(SIX SAMPLES) Δ6

NOTE: 10(6) THIS MEANS THAT IN THE OUTLINED AREA THERE ARE 10 SHORELINE ESTABLISHMENTS OF WHICH 5 WERE SURVEYED IN 1970.

SCALE IN MILES

ONTARIO DEPARTMENT OF HEALTH

PUBLIC HEALTH ENGINEERING SERVICE

MUSKOKA AREA

SPARROW LAKE

COTTAGE POLLUTION CONTROL PROGRAM — 1970 — 71

MORRISON TOWNSHIP

MARCH 31, 1971

MAP 70–06

MINISTRY OF THE ENVIRONMENT Private Waste and Water Management Branch